# Low-background Counting Facilities

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The LBNL Low Background Facilities (LBF) consist of a Berkeley site and an Oroville site especially configured for low-background gamma-ray spectroscopy. The Berkeley site was established in 1963 and consists of a 3m by 7m x 3m room surrounded by 1.6 m of specially selected low-background concrete shielding. The aggregate in this concrete is from serpentine gravel, which is extremely low in U, Th, and K, and emits very little radon.

Detectors at this site include a 20 cm diameter by 10 cm thick NaI crystal, two 30% p-type Ge spectrometers, two 80% p-type Ge spectrometers, with one available for field work, and a 115% n-type spectrometer suitable for observing Pb-210 and other low-energy decays. These detectors each have small local shields consisting of 10 cm of Pb. The overall shielding reduces background to the point where cosmic rays and activity within the detector assembly are the dominant sources of background.

The LBF Oroville site is located in the powerhouse of the Oroville Dam, under 180-m of rock cover. This site now has an 80% p-type Ge-spectrometer, and is used for our most sensitive counting, particularly for materials certification. Sensitivities of 50 parts-per-trillion (PPT) for U and daughters, 200 PPT for Th and daughters, and 100 parts-per-billion for K are realized at the Oroville site.

Over the years, the LBF has been involved in a wide variety of experiments supporting programs in basic and applied science from LBNL and a variety of other institutions. This last year, work mainly involved: 1) Analysis of shielding for the Bevalac decommissioning 2) various activities related the Cryogenic Underground Observatory for Rare Events CUORE), 3) use of automotive intake air filters as collectors for radioactive aerosols following a potential nuclear terrorist attack, 4) various neutron activation analysis experiments, and 5) materials certification work for CDMS and KamLAND.

This year, a large effort went into certification of excess Bevalac blocks for free-release by in-situ gamma-ray spectroscopy, measuring the levels of man-added radioactivity in the shielding blocks down to 1 pCi/g. Current studies also involve counting both concrete and steel components from the main Bevalac ring in order to determine the magnitude of the disposal project. Samples of nuts and washers around the ring have been counted to map out the radioactivity in the steel. Samples of concrete from inside the shielding have been examined to map out the activity in concrete around the ring. This work will continue during the coming year.

A large amount of work went into the actual construction of the Cuoricino (little CUORE) experiment in Italy. This experiment is presently running, and we hope to begin work on data analysis later this year. Neutron activation work continued on the NDT Ge thermistors for CUORE. Protocols are being developed to produce the one- to two-thousand nearly identical thermistors needed for CUORE. The work this year involved neutron activation analysis of fully-doped material as well as Secondary Ion Mass Spectroscopy (SIMS) to determine the dopant concentrations. This work will also continue into the coming year.

The facility continues to seek funding for its Homeland Security project involving automotive air filters as collectors for radioactivity following a terrorist incident, such as a "dirty" bomb. The sensitivity to Co-60 is better than 100 pico-Curies total activity on the filter, as determined from the natural Be-7 activity. This technique can be used to monitor the spread of radioactivity following a terrorist attack. Air filters from Berkeley and Oroville are being studied, as are calibration techniques.

Other projects in neutron activation analysis involved silicon samples for solar cell applications. Similar work involving the solubility of nickel in silicon will continue this year.

Certification of materials work continued for CDMS and KamLAND, involving direct counting of samples, mostly at the Oroville site.